PETITION FOR REVIVAL OF AN APPLICATION FOR PATENT ABANDONED UNINTENTIONALLY UNDER 37 CFR 1.137(b)	Docket Number (Optional) 7950.049.00

First named inventor: Seung-Myun BAEK et al.

Application No:	10/560,252	Art Unit:	2416
International Filing Date:	May 28, 2004	Examiner:	TBA

Title:

HOME NETWORK SYSTEM

Mail Stop PCT
Attention: PCT Legal
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

NOTE: If information or assistance is needed in completing this form, please contact Petitions Information at (703) 305-9282.

The above-identified application became abandoned for failure to respond to the notice mailed February 4, 2008.

APPLICANT HEREBY PETITIONS FOR REVIVAL OF THIS APPLICATION

NOTE: A grantable petition requires the following items:
(1)   Petition fee;
(2)   Reply and/or issue fee;
(3)   Request for Continued Examination
(4)   Statement that the entire delay was unintentional.

1. Petition fee

☐ Small entity – fee $ _____ (37 CFR 1.17(m)). Applicant claims small entity status. See 37 CFR 1.27.

☒ Large entity – fee $ ___1,620.00___ (37 CFR 1.17(m))

2. Reply and/or fee

A. The reply and/or fee to the above-noted Office action in the form of ___Response to Notice to File Missing Parts___ (identify type of reply):

☐ has been filed previously on _____ .

☒ is enclosed herewith.

B. The filing fees of $130 for the oath or declaration and $40 for Recordation of Assignment

☐ has been paid previously on _____ .

☒ is enclosed herewith.

Page 1 of 2

3. Terminal disclaimer with disclaimer fee

[X] Since this utility/plant application was filed on or after June 8, 1995, no terminal disclaimer is required.

[ ] A terminal disclaimer (and disclaimer fee (37 CFR 1.20(d)) of $ _____ for a small entity
or $ _____ for other than a small entity) disclaiming the required period of time
is enclosed herewith (see PTO/SB/63).

4. STATEMENT: The entire delay in filing the required reply from the due date for the required reply until the filing of a grantable petition under 37 CFR 1.137(b) was unintentional. [NOTE. The United States Patent and Trademark Office may require additional information if there is a question as to whether either the abandonment or the delay in filing a petition under 37 CFR 1.137(b) was unintentional (MPEP 711.03(c), subsections (III)(C) and (D))].

July 7, 2009	_Michael I. Angert_
Date	Signature

Telephone
Number: (202) 496-7500

Michael I. Angert, Reg. No. 46,522
Typed or printed name

MCKENNA LONG & ALDRIDGE LLP
1900 K Street, N.W.
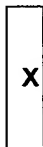Washington, DC 20006
Address

Enclosures:

[X] Check in the amount of **$1,790** (Petition Fee of $1620; Declaration Surcharge and Assignment Recordation Fee of $170)

[ ]

[ ] Terminal Disclaimer Form

[ ] Additional sheets containing statements establishing unintentional delay

[X] Other: Response to Notification of Missing Requirements attaching executed Declaration and Power of Attorney; executed Assignment & Cover Sheet; Notice of Abandonment; Notification of Missing Requirements; Information Disclosure Statement & PTO Form SB08A & 1 Non Patent Literature Reference

Page 2 of 2

DC:50632417.1
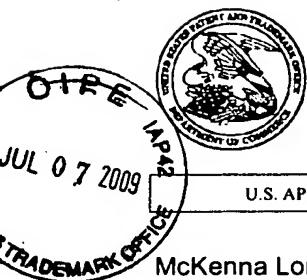
UNITED STATES PATENT AND TRADEMARK OFFICE

MRH MJA/RSR

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

JUL 0 7 2009

U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
10/560,252	Seung-Myun Baek	7950.049.00

McKenna Long & Aldridge
1900 K Street N W
Washington, DC 20006

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MAY 2 8 2009

McKENNA LONG & ALDRIDGE, LLP

INTERNATIONAL APPLICATION NO.	
PCT/KR04/01262	
I.A. FILING DATE	PRIORITY DATE
05/28/2004	05/30/2003

CONFIRMATION NO. 5027
371
ABANDONMENT/TERMINATION
LETTER

OC000000036124104

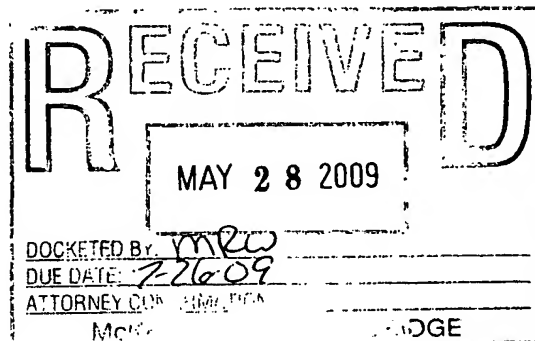## NOTIFICATION OF ABANDONMENT

Date Mailed: 05/26/2009

The United States Patent and Trademark Office in its capacity as a Designated / Elected Office (37 CFR 1.495) has made the following determination:

 • Failure to respond to notice mailed 2/4/2008

Therefore, the above identified application failed to meet the requirements of 35 U.S.C. 371 and 37 CFR 1.495,and is ABANDONED AS TO THE UNITED STATES OF AMERICA.

PATRICIA A BOOKER

Telephone: (703) 756-1409

RECEIVED
MAY 2 8 2009

DOCKETED BY: MRW
DUE DATE: 7-26-09
ATTORNEY COM
Mc   DGE

page 1 of 1

FORM PCT/DO/EO/909 (371 Abandonment Notice)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
PO Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
10/560,252	Seung-Myun Baek	7950.049.00

McKenna Long & Aldridge
1900 K Street N W
Washington, DC 20006

INTERNATIONAL APPLICATION NO.	
PCT/KR04/01262	
I.A. FILING DATE	PRIORITY DATE
05/28/2004	05/30/2003

CONFIRMATION NO. 5027
371 FORMALITIES LETTER

OC000000028080817

Date Mailed: 02/04/2008

NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371
IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

The following items have been submitted by the applicant or the IB to the United States Patent and Trademark Office as a Designated Office (37 CFR 1.494):

- Priority Document
- Copy of the International Application filed on 12/12/2005
- Copy of the International Search Report filed on 12/12/2005
- Preliminary Amendments filed on 12/12/2005
- Information Disclosure Statements filed on 12/12/2005
- U.S. Basic National Fees filed on 12/12/2005
- Priority Documents filed on 12/12/2005
- Specification filed on 12/12/2005
- Claims filed on 12/12/2005
- Abstracts filed on 12/12/2005
- Drawings filed on 12/12/2005

The applicant needs to satisfy supplemental fees problems indicated below.

The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

- Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), identifying the application by the International application number and international filing date.
- To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.492(h) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

SUMMARY OF FEES DUE:

Total additional fees required for this application is **$130** for a Large Entity:
- **$130** Surcharge.

ALL OF THE ITEMS SET FORTH ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTHS FROM THE DATE OF THIS NOTICE OR BY 32 MONTHS FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web. https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

PAULETTE R KIDWELL

Telephone: (703) 308-9140 EXT 216

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of: Seung-Myun BAEK et al.	Customer No. 30827
Application No. 10/560,252	Confirmation No. 5027
Filed: December 12, 2005	Art Unit: 2416
For: HOME NETWORK SYSTEM	Examiner: TBA

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO NOTIFICATION OF MISSING REQUIREMENTS

Dear Sirs:

This paper responds to the Notification of Missing Requirements mailed February 4, 2008.
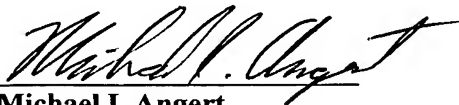
The enclosures are as follows:

- Check in the amount of $170.00 ($130=Declaration Surcharge; $40=Assignment Fee)
- Copy of the Notification of Missing Requirements
- Five (5) pages of Declaration and Power of Attorney
- Recordation Assignment Cover Sheet with Three-page Assignment Document

In light of the foregoing, this application is deemed to be in proper condition for examination and favorable action is earnestly solicited.

If these papers are not considered timely filed by the Patent and Trademark Office, then a petition is hereby made under 37 C.F.R. § 1.136, and any additional fees required under 37 C.F.R. § 1.136 for any necessary extension of time, or any other fees required to complete the filing of this response, may be charged to Deposit Account No. 50-0911. Please credit any overpayment to Deposit Account No. 50-0911.

Dated: July 7, 2009

Respectfully submitted,

By _[signature]_

   Michael I. Angert
Registration No. 46,522
McKenna Long & Aldridge LLP
1900 K Street N.W.
Washington, D.C. 20006
Voice: 202-496-7500
Fax: 202-496-7756
Attorneys for Applicant

07/08/2009 TLUU22   00000031 10560252

02 FC:1617   130.00 OP

Declaration and Power of Attorney

WE (I) the undersigned inventor(s), hereby declare(s) that:

My residence, post office address and citizenship are as stated below next to my name,

We (I) believe that we are (I am) the original, first, and joint (sole) inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled

HOME NETWORK SYSTEM

the specification of which

☐	is attached hereto.		
☐	was filed on	**December 12, 2005**	
		as Application No.	**10/560,252**
		and amended on	December 12, 2005
☐	was filed as PCT international application		
	Number	PCT/KR2004/001262	
	on	May 28, 2004	
	and was amended under PCT Article 19		
	on		(if applicable).

We (I) hereby state that we (I) have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

We (I) acknowledge the duty to disclose information known to be material to the patentability of this application as defined in Section 1.56 of Title 37 Code of Federal Regulations.

We (I) hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed. Prior Foreign Application(s)

Application No.		Country		Day/Month/Year	Priority Claimed			
KR 10-2003-0034962		**Republic of Korea**		**May 30, 2003**	☐	Yes	☐	No
PCT/KR2003/01347		**WIPO**		**July 7, 2003**	☐	Yes	☐	No
					☐	Yes	☐	No

We (I) hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below.

(Application Number)	(Filing Date)

We (I) hereby claim the benefit under 35 U.S.C. §120 of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.
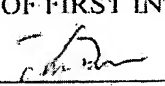
Application Serial No.		Filing Date		Status (pending, patented, abandoned)
		.		

We (I) hereby appoint the practitioners associated with Customer No. 30827, with full powers of substitution and revocation, to prosecute the patent application identified above and filed herewith and to transact all business in the U.S. Patent and Trademark Office connected therewith; and we (I) hereby request that all correspondence regarding this application be sent to Song K. Jung of McKenna Long & Aldridge LLP, Attorneys At Law, 1900 K Street, N.W., Washington, D.C. 20006.

We (I) declare that all statements made herein of our (my) own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon, and may jeopardize the validity of the patent application or any patent issued thereon.

___BAEK, Seung-Myun___
NAME OF FIRST INVENTOR

_____
Signature of Inventor

___June. 22. 200?___
Date

Residence: Changwon-shi, Republic of Korea

Citizen of:: Republic of Korea

Post Office Address: Lucky Apt. 12-403, Banlim-dong, changwon-shi, 641-764, Kyungsangnam-do, Republic of Korea

___LEE, Koon-Seok___
NAME OF SECOND INVENTOR

_____
Signature of Inventor

___June 22, 2009___
Date

Residence: Changwon-shi, Republic of Korea

Citizen of: Republic of Korea

Post Office Address: Sungwon Apt. 102-1406, 45-1 Sangnam-dong, Changwon-shi 641-778, Kyungsangnam-do, Republic of Korea

CHOI. Hwan-Jong
NAME OF FIRST INVENTOR

Residence: Buk-ku, Republic of Korea

Citizen of:: Republic of Korea

Signature of Inventor

Post Office Address: 909-13, Manduk 3-dong, Buk-ku
616-829, Busan, Republic of Korea

Date

KIM. Yong-Tae
NAME OF SECOND INVENTOR

Residence: Gimhae-shi, Republic of Korea

Citizen of: Republic of Korea

Signature of Inventor

Post Office Address: Daedong Apt. 1006-1504.
Mukea-ri, Jangyou-myun, Gimhae-shi 621-833,
Kyungsangnam-do, Republic of Korea

Date
888

KOO. Feel-Young
NAME OF FIRST INVENTOR

Residence: Minrak-dong, Republic of Korea

Citizen of:: Republic of Korea

Signature of Inventor

Date   Jun. 20, 2009

Post Office Address: Keukdong-Villa No. 407, 542,
Minrak-dong, Suyoung-ku 613-829, Busan., Republic
of Korea

KOO. Ja-In
NAME OF SECOND INVENTOR

Residence: Jinju-shi, Republic of Korea

Citizen of: Republic of Korea

Signature of Inventor

Post Office Address: 336-28, Hadae-dong, Jinju-shi
660-997, Kyungsangnam-do, Republic of Korea

Date
**

CHOI, Hwan-Jong
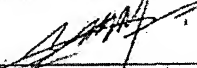NAME OF FIRST INVENTOR

Signature of Inventor

2009, 06, 23
Date

Residence: Buk-ku, Republic of Korea

Citizen of:: Republic of Korea

Post Office Address: 909-13, Manduk 3-dong, Buk-ku 616-829, Busan, Republic of Korea

KIM, Yong-Tae
NAME OF SECOND INVENTOR

Signature of Inventor

2009 06. 22 .
Date
888

Residence: Gimhae-shi, Republic of Korea

Citizen of: Republic of Korea

Post Office Address: Daedong Apt. 1006-1504, Mukea-ri, Jangyou-myun, Gimhae-shi 621-833, Kyungsangnam-do, Republic of Korea

KOO, Feel-Young
NAME OF FIRST INVENTOR

Signature of Inventor
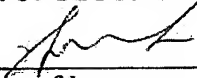
Date

Residence: Minrak-dong, Republic of Korea

Citizen of:: Republic of Korea

Post Office Address: Keukdong-Villa No. 407, 542, Minrak-dong, Suyoung-ku 613-829, Busan,, Republic of Korea

KOO, Ja-In
NAME OF SECOND INVENTOR

Signature of Inventor

2009. 06. 22
Date
**

Residence: Jinju-shi, Republic of Korea

Citizen of: Republic of Korea

Post Office Address: 336-28, Hadae-dong, Jinju-shi 660-997, Kyungsangnam-do, Republic of Korea

KANG, Seong-Hwan
NAME OF FIRST INVENTOR

Signature of Inventor

2009. 6.22
Date

Residence: Seolcheon-myun, Republic of Korea

Citizen of:: Republic of Korea

Post Office Address: 1128, Keumeum-ri, Seolcheon-myun, Namhae-kun 668-891, Kyungsangnam-do, Republic of Korea

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF:
Seung-Myun BAEK et al.   GROUP ART UNIT: 2416

SERIAL NUMBER: 10/560,252   EXAMINER: TBA

FILED: December 12, 2005

FOR: HOME NETWORK SYSTEM

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. 1.97

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

      Applicant(s) wish to disclose the following information.

REFERENCES
■   The Applicant(s) wish to make of record the references listed on the attached PTO/SB/08. Copies of the listed references are attached, where required, as are either statements of relevancy or any readily available English translations of pertinent portions of any non-English language references.

RELATED DOCUMENTS
☐   For the Examiner's convenience, Applicant(s) wish to make of record the following document(s):
    ☐ International Search Report from PCT/_____/_____, dated _____;
    ☐ Written Opinion of the ISA from PCT/_____/_____, dated _____;
    ☐ Search Report of _____ Patent Office in Appl'n No. _____, dated _____;
    ☐ Office Action of _____ Patent Office in Appl'n No. _____, dated _____;
    ☐ Office Action of the U.S. Patent Office in Appl'n No. _____, dated _____;
    ☐ _____.

The above-cited document(s) are not prior art. The above-cited document(s) should not appear on the face of any patent that issues from the above-identified application. Accordingly, these document(s) are not listed on the attached PTO/SB/08. These document(s) are believed to be relevant only in that they identify one or more of the documents cited on the attached PTO/SB/08, or were issued in another application associated with the inventor(s) and/or applicant(s) of this application.

RELATED CASES
☐   A list of Applicant's pending applications or issued patents, which may be related to the present application, is attached.

CERTIFICATION
   The undersigned certifies that:

☐   each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement.

☐   no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after having made reasonable inquiry, no item of information contained in this information disclosure statement was known to any individual designated in 37 CFR § 1.56(c) more than three months prior to the filing of this information disclosure statement.

FEES
☐   A check is attached in the amount required under 37 CFR § 1.17(p) for taking action under 37 CFR § 1.97(c) or (d).

DEPOSIT ACCOUNT
■   Please charge any additional fees for the papers being filed herewith and for which no check is enclosed herewith, or credit any overpayment to Deposit Account No. 50-0911.

                                          Respectfully submitted,

Date: July 7, 2009

                                          Michael I. Angert
                                          Registration No. 46,522
                                          MCKENNA LONG & ALDRIDGE LLP
                                          1900 K Street, N.W.
                                          Washington, D.C. 20006
                                          Telephone No: 202-496-7500

Substitute for form 1449/PTO ## INFORMATION DISCLOSURE ## STATEMENT BY APPLICANT *(use as many sheets as necessary)*	**Complete if Known**	
	Application Number	10.560,252
	Filing Date	December 12, 2005
	First Named Inventor	Seung-Myun BAEK et al.
	Art Unit	2416
	Examiner Name	TBA

Sheet	1	of	1	Attorney Docket Number	7950.049.00

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA	5,867,666	92.92.1999	Harvey	
		7,062,531 B2	06/13/2006	Kim	
		7,257,104 B2	08/14/2007	Shitama	
		7,353,259 B1	04/01/2008	Bakke et al.	
		7,389,332 B1	06/17/2008	Muchow et al.	
		7,421,478 B1	09/02/2008	Muchow	
		7,461,164 B2	12/02/2008	Edwards et al.	
		2005/0190727 A1	09/01/2005	Vanlieshout et al.	
		2004/0158333 A1	08/12/2004	Ha et al.	
		5,519,858	05/21/1996	Walton et al.	
		6,366,583 B2	04/02/2002	Rowett et al.	
		2003/0065824 A1	04/03/2003	Kudo	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	BA					

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the application number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Lee et al., "A New Control Protocol for Home Appliances - LnCP, 2001IEEE, pgs. 286-291	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

Examiner Signature		Date Considered	

DC:50632446.1

A NEW CONTROL PROTOCOL FOR HOME APPLIANCES - LnCP

Koon-Seok Lee*, Hoan-Jong Choi*, Chang-Ho Kim**, Seung-Myun Baek*

*Digital Appliance Company Research Lab.,
**Digital Appliance Research Lab.,
LG Electronics Inc.

ABSTRACT

This paper proposes a new control protocol, LnCP(Living network Control Protocol), targeting at low implementation cost networking system in home environment. The protocol is based on multi-master system and uses a peer-to-peer communication model. The protocol assumes single bus therefore the appliances can be attached to the bus anywhere if the power lines are employed as network bus. Home appliances linked via LnCP are controlled and monitored at remote place. Every device communicates with each other in packet unit, which has variable length so that the protocol can deal with the devices having the diverse room of RAM resource. The bytes number of packet header is also variable in order that new function can be added in the future.

The minimum hardware requirements to implement the protocol are 8-bit processing microcomputer including built-in UART, 17 bytes of volatile memory and few bytes of non-volatile memory. Therefore it may be embedded in low-cost microcontrollers that are employed in the white goods such as refrigerator, washing machine, micro oven range and even light switch.

1. INTRODUCTION

There are so many attempts to maintain some degree of standardization for home automation applications. For example the X10, LonTalk and CEBus standards define the communication protocols, interface standards and other technical aspects. Although the X10 [2] has been around since the 1970's it is typically suited for simple on/off control that is a misconception about what the home automation actually is. The CEBus[1] have been developed with the purposes of home automation applicable to all home appliances such as TV, Audio, Video, refrigerator and even light lamp. As the result the generality is guaranteed in parts and it gives manufacturers the chance to make network devices without developing any application protocols. LonTalk[3] was designed for communication in control network so that the it is characterized by short message and low speed. However

the standardizations that many companies have pursued until now may cause following two basic problems.

• Heavyweight level application in viewpoint of microcontroller employed by white goods.
• High implementation cost because of additional communication module.

These problems are explained as follows. Home appliances can be classified into three subnets according to the communication speed and the amounts of transmitting data. The first subnet is consists of multimedia appliances like TV, Video and Audio, which deal with mainly image data. The second subnet is structured with PC and peripheral devices such as printer, fax, and scanner. The third subnet is made up of white goods, which need to control, monitor the state of appliance and load small size of data. We call those by AV-net, PC-net and living-net for convenience respectively. The appliances belonging to each subnet have broad spectrum in the cost and function aspects. Existing protocols support the services and maintenance not only on specific subnet but also on home network integrating all subnets. And also the protocols do not consider implementation with microcontroller of appliance but requires the additional communication module. Therefore these lead to heavyweight protocol because there must be networking and routing mechanism, and that there must be interpreter of common language like CAL in CEBus. Therefore in the viewpoint of controller's capability it is difficult to implement for white goods that employ 8-bit processing microcomputer at most. As far as the white goods use low-speed microcomputer because of the limitation of acceptable price the end-user must possess additional communication module where most layers of the protocol are implemented for each appliance.

To overcome above problems cost-effective and appliance-oriented protocol, LnCP(Living network Control Protocol), is proposed. The proposed protocol is simple and it is sufficiently implemented in existing white goods without additional communication module if they operate with 8-bit processing microcontroller. This paper focuses on the concepts of LnCP as a low cost solution for home networking and therefore the detail specifications are not described.

ISIE 2001, Pusan, KOREA

Section 2 introduces how to construct network via LnCP, and section 3 for the concepts and layering. In section 4 the packet structure is presented, while the communication architecture using this packet is described in section 5. Section 6 deals with the message that is a language to control appliances. Finally, summarize the features of LnCP in section 7.

2. OVERVIEW OF LnCP

2.1. Living Network and Its concepts

The network is constructed by linking appliances, which implement the LnCP on their microcontroller, via a networking bus. Some appliances that do not have micorocontroller are combined with a module, which contains LnCP and enables them to be networked, as shown in Figure 1. Single wire or power lines are the candidates for the medium as networking bus. If power line is used as medium then each appliance must connect to power line transceiver, whose encoding method is not defined in LnCP. Any appliance or the combination of appliance and a module, which is attached to the bus on the network, is referred to as a node. The network interface must ensure that each node has half duplex communications, and can sense activity on the network.
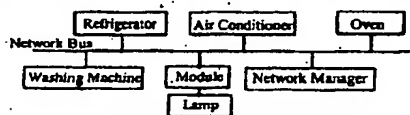

Figure 1: Network Structure

The LnCP allows any node on the bus to communicate with and control any other node in living network. Even the LnCP introduce the network management device to interface with user through keyboard and screen, there is no central control device. Consequently there is no hierarchy on product-to-product communications. LnCP covers only the node communication protocol; the protocol intended for home appliances in living network. It does not cover the Router communications protocol.

Since LnCP allows communication of a variety of data types, from simple control commands, to more complex information such as image data and program code, the networked appliances can provide the user the following functions:

• Control : Control the appliances on/off or variable power.
• Monitoring : Monitor the operating state and sensor of appliances.

• Automation : Automatic control between devices without user operating.
• Download : Upgrade the software in microcontroller to enhance the basic functions or add new functions.

2.2. Protocol Layers

The protocol is based on the ISO Open Systems Interconnect(OSI) seven layers network protocol model. LnCP layering consists of the Physical Layer, Data Link Layer and Application Layer. Each layer follows the divisions established by the OSI standard for protocol tasks. The layering is described below.

Physical Layer is responsible for data encoding and decoding. Although LnCP does not define this layer the LnCP use UART as a default encoding method for the simplicity of implementation because many microcontrollers have the built-in UART adapter and PC also provide that service. Data Link Layer(DLL) is divided into MAC(Medium Access Control) layer and Link layer. MAC employs collision avoidance algorithm. Link layer handles reception of packets over the attached medium, address recognition, error detection, packet timing, packet retransmission and detection of the duplicate message. Application Layer is responsible for message generation, message reception, message execution and message fragmentation.

3. KEY FEATURES OF LnCP

The LnCP is based on the multi-master system. Accordingly every product can be classified into two categories, master and slave. Master is that sends slave a message to begin conversation when any event is generated by user or some algorithm and has total control over the network for the duration of that communication. It is noted that the master is not in the state of "listening" if he did not make a conversation with other devices. Slave responds to the master's request. If there is no any request from other devices the slave has to listen to network bus. According to definitions product-to-product communication is only enabled by master and is only accomplished between master and slave. The communication between masters cannot be accomplished.
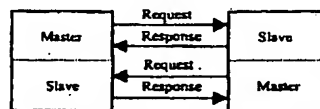

Figure 2. Structure of P2P device.

To enable actual peer-to-peer communications, LnCP defines a new device, named P2P device. P2P device is defined as the device having logical LnCP compliant master and slave as in Figure 2. That is to say, the P2P device acts as slave normally and as master when any event is generated. The device name, P2P, means that the "peer-to-peer" communication is possible. The introduction of P2P device gives the developer following three benefits. The first is that it is sufficient to develop the networked appliance enabling product-to-product communication by only understanding the master-slave communication mechanisms. Secondly, in viewpoint of software engineer it is easy to program the communication algorithm because the device is divided into two logical devices that perform different tasks independently. Thirdly, the developer can make a decision easily to eliminate optional communications mechanisms considering the disturbance to basic functions such as washing, cooking and heating.

Although each layer represents a division of responsibility of the protocol and can be implemented independently, all layers share the same memory for buffering to minimize use of RAM. This is a result of taking into consideration of actual situation in white goods, which employs generally the 8-bit processing microcontroller that has the small size of RAM. Since the LnCP is implemented in microcontroller that have also basic functions, it is difficult to assign much memory for communications. Thanks to the half duplex communication stated above the receiving and transmitting tasks also can share the same memory if the device acts as master or slave. This restriction on memory use leads to cost-effective and easy-to-use protocol for appliance developers in that the protocol must have the simple communication architecture. In case of P2P device, even if it were half duplex communication, the memory for logical master to transmit has to be divided from shared buffer because it needs the memory to keep for retransmission until the transmitting process is completed.

- Master and slave : Use a memory array to receive and transmit in Data Link and Application Layers.
- P2P device : Use a memory array for master to transmit in Data Link and Application Layers. And an additional memory array for slave to receive and transmit, for master to receive in Data Link and Application Layers.

The LnCP uses a connectionless service protocol. This means that devices gain access to the network bus only long enough to transmit a message and then get off[2]. No connection is formed between two devices to communicate, tying the network up during their conversation. To share the bus among many devices the protocol provides short messages limited to 255 bytes and defines the minimum delay time between packet transmissions.

4. PACKET STRUCTURE

Since LnCP does not define the requirements for the Physical Layer in detail the signal frame on the medium is also not defined. Therefore the protocol defines only the packet to communicate on a peer-to-peer basis with Data Link Layer. Each packet is made up of a header, a body and a trailer. Header, body and trailer contain the communication, control, and error detection information respectively.

Header										Body		Trailer
HC	RX	TX	PL	AP	PHL	PV	PT	RC	PI	MH	MSG	CRC	ETX

Figure 3: Packet structure

HC : Home Code(8bit), Rx: Receiver Address(16bit),
Tx : Sender Address(16bit), PL : Packet Length(8bit),
AP : Access priority(3bit), PHL : Packet Header Length(5bit),
PV : Protocol Version(9bit), PT : Packet Type(4bit),
RC : Retransmission Count(2bit), PI: Packet Identification(2bit),
MH : Message Header, MSG : Message,
CRC : Cyclic redundancy check(16bit), ETX : 8bit

5. LINK LAYER

When packet data are received from other device, the Data Link Layer investigates recipient address, packet type, protocol version and bit error with the information of header and trailer. If there is not any error in packet data that layer hand the body data over Application Layer. When body data are received from Application Layer, the Data Link Layer structures a packet, controls the communication process and that passed the packet data to MAC layer.

5.1. Addressing

In LnCP the sender designates the recipient using home code and address. HC indicates identifies home code and

Physical address(8bit)	Logical address(8bit)
Product code	Device address
	Area code

Figure 4. The structure of address field

Product name	Product code	Address range
Network manager	0x00	· ·
Refrigerator	0x01	0x0100–0x01FE
Air conditioner	0x02	0x0200–0x02FE
Washing machine	0x03	0x0300–0x03FE
:	:	:

Figure 5. Product codes

is useful for differentiating the house from neighbors when many houses share the same medium like the power line. RX and TX identify the addresses of the recipient and transmitting devices, respectively. The first byte in the address field is product code, which is assigned with a unique value identifying the basic function of residential products and has nothing to do with the vender. Even there is a little difference in functions between two types of product, for example washing machines operating with pulsator and drum, the products have the same codes. This code is predefined by LnCP and stored in ROM and hence physical address, which differs from serial number in Ethernet card in that all refrigerators over the world have the same value. The second byte is the logical address to classify the devices having the same product code. The logical address may be device address or area code. Device address is used for addressing the appliances having the same name. Area code is allocated according to the installed area in home. Home code and logical address are stored in non-volatile memory such as EEPROM and flash ROM.

Group address is assigned as all bits in each subfield are set to "1". For example, 0x01XX indicates the group address of refrigerators, where XX means "don't care". 0x3FXX is a group address indicating all appliances that have the same area code. Because the grouping logic in LnCP is oriented to home environment it is very powerful for home automation.

5.2. Transport Protocol

The transport protocol use PT and RC values. LnCP defines three types of packet, that is, request packet, response packet and notification packet. Request packet is transmitted from master to control or get the information of slave. Response packet is transmitted from slave to respond to the master's request. And response packet is divided into successful response packet which includes
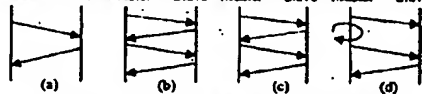

Figure 6. Protocol diagram for retransmission

Solid line : Normal transmission, Dotted line : bit error, Circle : waiting
(a)Normal conversation
(b)Retransmission when bit error in request packet
(c)Retransmission when bit error in response packet
(d)Retransmission when no response packet.

ACK message or NAK message, and failed response packet, which must include NAK message. When the master receives the failed response packet it can retransmit the original packet three times at maximum. If there is any bit error with received request packet then the slave transmits the failed response packet. Otherwise the slave transmits the successful response packet even though the message is not executed successfully because of an error with arguments in message, duplicate message reception and so on. Notification packet is transmitted from master and the recipients do not respond to that.

Using the above packets the protocol makes three types of conversation in point of master view as follows.

- 1-request and 1-response : it is a normal conversation between 1-master and 1-slave. Master terminates the conversation when it receives a successful response packet or when there is no response within maximum waiting time.

- 1-request and multiple-response : it is the case of using group address as the recipient. Master continues to receive the response until the maximum waiting time elapse. There is no retransmission.

- 1-notification : it is an one-sided conversation.

To control these conversations master uses RC value. The master increments the RC value by 1 whenever it retransmits the original packet. The initial value is 1 and the maximum value is 3. For the slave cannot control the conversation it always sets RC value to 1. The master retransmits the packet when it is elapsed the maximum waiting time after sending a request packet as well as when he received a failed response packet. To keep the protocol performance in network environment the slave discards the reception of response packet.

5.3. Error Detection

Each layer has its own error detection mechanism to minimize the probability of malfunction. The Link Layer utilizes a 16 bit cyclic redundancy check(CRC). The 16 bit CRC can detect all single/double bit errors, all errors with odd bits, and burst errors of length <16, with 99.997% accuracy. And the simulation result yields a maximum of only one undetected error in 1,000,000 faulty packets[4].

5.4. The others

PL length defines the number bytes within the packet including HC and ETX. The packet length is variable and the value depends on the lengths of header and message. Each appliance defines the PL in consideration of

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available memory in range of 17 to 255. PHL is the length of packet header form HC to PN. Its value is in the range of from 9 to 32 bytes such that the new functions can be added to upgrade the compatible protocol with the lower version. PV means the protocol version.

PI is the packet identification and the sender increments its value by 1 whenever it transmits a new packet except that it retransmits. The value is reset to 0 when the device is rebooted or when the transaction count has reached its maximum value. The PN fields are combined to RC value to investigate the duplicate packet and hence the same bit length with the RC field.

AP controls the priority of access to the medium and is assigned to each transmitted packet. It is used to determine how soon it can contend for medium access after the last packet in MAC layer.

6. APPLICATION LAYER

As described in previous section there is no the information about the message segmentation into several shorter messages and message reassembly. The LnCP assigns that task to the Application Layer because of the following reason. It is due to sharing the buffering memory by Data Link Layer and Application Layer. Two layers support packet payload up to the same bytes in length, which depends on the size of memory available for the messaging buffer. Eventually the tasks dealing with long message is performed in Application Layer by defining the variable-sized message.

6.1. Message

A message in this paper is defined as a set of elements that have information to control the communication process and analyze the results of that in the point of master view. Message is divided into two categories according to the type of device who makes a message, request and response messages.

Request message includes the command and the arguments to execute it. There are two kinds of response message, ACK and NAK messages. The response messages include the copy of command code, ACK/NAK and return arguments generated after execution of command code. The bytes number of the each argument is fixed definitely to each command code.

$$Message = \{\{Request\ message\}, \{Response\ message\}\}$$
$$= \begin{cases} \{Command\ code,\ Input\ arguments\}, \\ \{Command\ code\ copy,\ ACK,\ Return\ arguments\}, \\ \{Command\ code\ copy,\ NAK,\ Error\ code\} \end{cases}$$

Message field is characterized by message header that contains the message length(ML), message header length(MHL) and port number(PN). ML is the value MHL plus the bytes number of message field.

MHL is the bytes number from ML field to the byte just before message field. Owing to variable PHL and MHL fields the message header defined above is extensible. For example, the Application layer can specify whether data should be transmitted with or without security adding that field in message header. PN allows the various application languages for Application Layer in spite of LnCP has its own language.
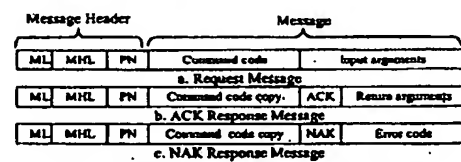
Message Header			Message		
ML	MHL	PN	Command code		Input arguments

a. Request Message

ML	MHL	PN	Command code copy	ACK	Return arguments

b. ACK Response Message

ML	MHL	PN	Command code copy	NAK	Error code

c. NAK Response Message

Figure 7. Message Structure

ML : Message Length(8bit), MHL : Message Header Length(8bit),
PN : Port Number(8bit)

6.2. Message Set

LnCP classifies the message into common and appliance specific sets. The common set is also divided into network management messages and product operating messages such as control of user interface and memory. Each message set classified above has also optional and required messages.

The purpose of the message in LnCP focuses mainly on the control or monitoring of the home appliances. Therefore the bytes number of message is generally very short(under 10bytes) and is predetermined according to specific functions, of which name is fixed-length message. Consequently there is no necessity to segment and

Message name	Power control	
Command code	0x05	
	Name	Data type
Input arguments	Power value	unsigned char
Return arguments	.	.
Comments	"Power value" is in range of 0 to 255. 0 means "off" and 255 means "on" with full power	

Figure 8. An example of fixed-length message

Message name	Write memory	
Command code	0x81	
	Name	Data type
Input arguments	Memory type	unsigned char
	Total message no.	unsigned short int
	Message no.	unsigned short int

	Start address Byte no. Data unit Data	unsigned long unsigned char unsigned char unsigned char [ ]
Return arguments	.	.
Comments	"Memory type" is EEPROM(0), 8-bit memory(1) or 16-bit memory(2).	

Figure 9. An example of variable-length message

reassemble for this message provided that the microcontroller has the sufficient memory to buffer such message data. Figure 8 is an example of fixed-length message of power control in C language expression. In this case the length of message field is 2.

Contrary to fixed-length message variable-length message handles long message such as image data and programming code. This message is segmented into enough shorter messages to store in the available memory, accordingly it has to contain the variable implying the packet number as input arguments. Figure 9 is the examples of the variable-length message. In this case the maximum length(N) of data fragmented is given as follows.

$$N = PL - PHL - MHL - 3 - 11.$$

where 11 means the bytes number of input arguments except data array.

Owing to calculation of the argument values with each segmented message it seems to be somewhat complex to handle the variable-length message but not for the fixed-length message. Furthermore the variable-length message is used for upgrading the contents of memory such as image file or new program codes. It is therefore definite that only the high-end device like PC uses the variable-length message in request packet, while most appliances, which do not have convenient user interface sufficient to handle the above tasks, only use the fixed-length message even if it act as master. In other word, there is no necessity to deal with long message and hence very simple to implement the protocol in case of white goods. This is one of the key concepts of the LnCP focusing on implementation in existing microcontroller with low cost.

Error code in Figure 7 is also similar in classification to the message set. While the common error codes include the bit error in packet, bad command and illegal arguments, the appliance specific error codes are relate to faults or troubles during operation. The detail specification is out of scope to touch in this paper.

7. SUMMARY AND COMMENTS

A new control protocol for home appliances has been proposed. The main advantage of the proposed protocol is to build a network at very low cost in home environment.

The protocol is simple and easy-to-use for developer, while there is no limitation to construct home network. The minimum requirements for the system are listed below.

- 8-bit processing microcomputer
- Built-in UART(half-duplex or full-duplex)
- 17 bytes of RAM
- Few bytes of non-volatile memory
- Under 2 Kbytes of ROM
-

Some parts of the protocol developed has been tested and applied to mass-production. Work is now continuing on the development of network management protocol, encryption algorithm, and on the development of software connecting to external network such as Internet.

8. REFERENCES

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[3] LonTalk Protocol Specification Version 3.0
[4] P. Warriner and K. Z. Karan, "NUDAN-A multi-functional Home Automation Network", IEEE Transactions on Consumer Electronics, Vol 44. No. 2, pp360-369, May 1998
[5] William Stallings, "Data and Computer Communications, Third Edition" Maxwell Macmillan International Editions, 1991

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	Customer No. 30827
Seung-Myun BAEK et al.	
Application No. 10/560,252	Confirmation No. 5027
Filed: December 12, 2005	Art Unit: 2416
For: HOME NETWORK SYSTEM	Examiner: TBA

Mail Stop PCT Legal Administration
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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RESUBMITTAL OF
"PETITION FOR REVIVAL OF AN INTERNATIONAL APPLICATION FOR PATENT
DESIGNATING THE U.S. ABANDONED UNINTENTIONALLY UNDER 37 C.F.R. 1.137(B)"
<u>**FOR THE RECORDS AND REFERENCE OF THE OFFICE**</u>

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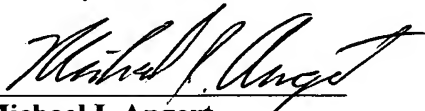
Dear Sirs:

Please find attached hereto a copy of a "Petition For Revival Of An International Application For Patent Designating The U.S. Abandoned Unintentionally Under 37 C.F.R. 1.137(b)," originally filed at the USPTO on December 12, 2005. This document is for the records and reference of the USPTO. Also enclosed is a USPTO date-stamped postcard receipt as proof of the December 12, 2005 filing.

Applicant respectfully requests the Office to forward, to the correspondence address associated with this application, a copy of the original GRANT of the December 12, 2005 Petition, for the Applicant's records.

Dated: <u>July 7, 2009</u>

Respectfully submitted,

By _____
Michael I. Angert
Registration No. 46,522
McKenna Long & Aldridge LLP
1900 K Street N.W.
Washington, D.C. 20006
Voice: 202-496-7500
Fax: 202-496-7756
Attorneys for Applicant

PETITION FOR REVIVAL OF AN INTERNATIONAL APPLICATION FOR PATENT DESIGNATING THE U.S. ABANDONED UNINTENTIONALLY UNDER 37 CFR 1.137(b)	Docket Number (Optional) 7950.049.00

First Named Inventor: Seung-Myun BAEK

International (PCT) Application No.: PCT/KR2004/001262

U.S. Application No.:
(if known)

Filed: May 28, 2004 (International Filing Date)

Title: HOME NETWORK SYSTEM

Attention: PCT Legal Staff
Mail Stop PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

The above-identified application became abandoned as to the United States because the fees and documents required by 35 U.S.C. 371(c) were not filed prior to the expiration of the time set in 37 CFR 1.495(b) or (c) as applicable. The date of abandonment is the day after the date on which the 35 U.S.C. 371(c) requirements were due. See 37 CFR 1.495(h).

APPLICANT HEREBY PETITIONS FOR REVIVAL OF THIS APPLICATION

NOTE: A grantable petition requires the following items:
- (1) Petition fee
- (2) Proper reply
- (3) Terminal disclaimer with disclaimer fee which is required for all international applications having an international filing date before June 8, 1995; and
- (4) Statement that the entire delay was unintentional.

1. Petition fee
   ☐ Small entity - fee $_____ (37 CFR 1.17(m)). Applicant claims small entity status. See 37 CFR 1.27.

   ☒ Other than small entity - fee $_1500.00_ (37 CFR 1.17(m))

2. Proper reply

   A. The proper reply (the missing 35 U.S.C. 371(c) requirement(s)) in the form of
   the 35 USC §371(c) National Stage App. (identify type of reply):

   ☐ has been filed previously on _____.

   ☒ is enclosed herewith.

[Page 1 of 2]

PTO/SB/64/PCT (10-05)
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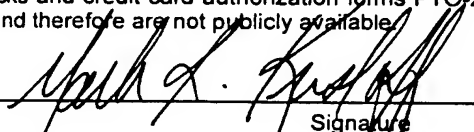
3. Terminal disclaimer with disclaimer fee

[X] Since this international application has an international filing date on or after June 8, 1995, no terminal disclaimer is required.

[ ] A terminal disclaimer (and disclaimer fee (37 CFR 1.20(d)) of $ _____ for a small entity or $_____ for other than a small entity) disclaiming the required period of time is enclosed herewith (see PTO/SB/63).

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[X] Fee Payment

[ ] Terminal Disclaimer

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Atty Docket No.: 7950.049.00-US

Applicant: Seung-Myun BAEK, et al.

Application No.: TBA   **Filing Date:** December 12, 2005

Title: HOME NETWORK SYSTEM

Documents Filed:

Transmittal Letter to the United states Designated/Elected Office (DO/EO/US) (2 pages)

PCT Application (18 pages specification, figures 8 pages)

International Search Report (3 pages)

PCT Written Opinion (3 pages)

PCT/IB/304 (1 page)

Preliminary Amendment (3 pages)

Information Disclosure Statement w/ PTO/sb/08/a/b and 1 reference

Petition for Revival of an International Application for Patent Designating the U.S. Abandoned Unintentionally under 37 CFR 1.137(b) (2 pages)

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Sender's Initials: MRK/syc   **Date:** December 12, 2005